



INDUSTRIAL ENVIRONMENTAL RESEARCH BRIEF

Status of EPA Regulatory and Research Activities Affecting Oil Shale Development*

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Abstract

The Environmental Protection Agency and the respective State Departments of Health are involved in a joint partnership with shared responsibilities for protecting the environment during the development of the oil shale resource. Legislation in the form of the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, Safe Drinking Water Act, and the Toxic Substances Control Act provide the framework for EPA's regulatory responsibilities. The current status of implementing regulations and agency policies vis-a-vis these Acts is provided in this paper. Also, important aspects of Colorado, Utah, and Wyoming environmental regulations are provided.

Key activities of EPA's oil shale environmental research program are discussed. Of special note is the completion of a document entitled "Environmental Perspective on the Emerging Oil Shale Industry." This document is the first of a series which will communicate EPA regulatory policies, state-of-knowledge of oil shale environmental impacts, and will provide EPA's environmental control technology expectations.

EPA's efforts to plan, design, and implement a comprehensive synthetic fuels research and regulatory strategy are also described. The policy level Alternative Fuels Group has been charged with the development of this strategy for oil shale, coal gasification, coal liquefaction and ethanol.

Introduction

EPA has legislative mandates to protect air and water quality, to insure a safe drinking water supply, and to provide for an environment conducive to the enjoyment of man on this earth. In order to accomplish these goals, EPA is involved in a partnership with State and local environmental agencies in the planning, implementation and enforcement of legislation and regulations. EPA and the State environmental agencies recognize that environmental considerations play a role in the determination of answers to the question of oil shale — how much? and when?

This paper will (1) highlight the EPA environmental regulatory requirements for the oil shale industry, (2) discuss EPA's key oil shale research activities, (3) describe EPA's new organization strategy aimed at the design and implementation of a comprehensive regulatory and research strategy for synthetic fuels, (4) pose environmental questions regarding oil shale development which remain unanswered.

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Regulatory Activities

EPA is responsible for various regulatory activities which affect the construction and operation of oil shale facilities. Enabling legislation and implementing regulations in the form of the Clean Air Act Amendments of 1977 (PL 95-95), the Clean Water Act Amendments of 1977 (PL 95-217), and Safe Drinking Water Act of 1974 (PL 93-523), the Resource Conservation and Recovery Act (RCRA) of 1976 (PL 94-580), the Toxic Substances Control Act (TSCA) of 1976 (PL 94-469), and to a lesser extent the Noise Control Act of 1972 (PL 92-574) establish the regulatory framework through which EPA operates. Of course, the National Environmental Policy Act of 1969 (PL 91-190) is also a significant environmental legislative authority (Table 1).

TABLE 1. EPA LEGISLATIVE MANDATES

Clean Air Act Amendments of 1977	PL 95-95
Clean Water Act Amendments of 1977	PL 95-217
Safe Drinking Water Act of 1974	PL 93-523
Resource Conservation and Recovery Act of 1976	PL 94-580
Toxic Substances Control Act of 1976	PL 94-469
Noise Control Act of 1972	PL 92-574

Papers presented by EPA at the 11th and 12th Oil Shale Symposia have described in some detail the requirements of these Acts and their implementing regulations. No major revisions to our basic legislation have occurred in the past year. This paper will discuss changes to regulations over the past year. Lawsuits, litigation, and court decisions have played a major role in reshaping some of EPA's regulatory programs.

Perhaps of most interest at the present time to the oil shale industry is the EPA promulgation of RCRA regulations. Partial fulfillment of a court order occurred with the promulgation of regulations satisfying Parts 3002, 3003, and 3010 on February 26, 1980. Criteria for defining a hazardous waste (3001) and general performance standards for the treatment, storage, and disposal of a hazardous waste were promulgated

on May 19, 1980. These performance standards will be based upon a concept of Best Engineering Judgment (BEJ), as defined by the permit writer on a case-by-case basis. The BEJ concept is consistent with Best Available Control Technology (BACT), ded capability and potential for accomplishments greater than those possible by support of individual projects alone.

TSCA requirements have been an issue and concern to oil shale interests in the past. In June of 1979, EPA published its inventory of existing chemicals. Shale oils are included in the inventory. A review of the appropriateness of including shale oil in this inventory is presently underway. If shale oil remains on the list, developers are exempt from the testing requirements of pre-market notification. The action would not exempt developers from future EPA enforcement actions. If the manufacture and use of a chemical are found to cause substantial endangerment to human health, options available to EPA include ban of manufacture, restrictions on transport and/or use, and precautionary labeling. The Act also provides a backup for other EPA legislation for the control of toxic emissions and effluents.

The Alabama Power vs. EPA decision changes some of EPA's Prevention of Significant Deterioration of Air Quality (PSD) regulations. Proposed regulations to satisfy the initial court ruling were published on September 5, 1979 and were promulgated by August 7, 1980. Changes will include (1) the need for a BACT assessment for all pollutants regulated under the Act (Table 2) except where controlled emissions will be

TABLE 2. POLLUTANTS REGULATED UNDER THE CLEAN AIR ACT AMENDMENTS OF 1977

NAAQS	NON-NAAQS
Particulate Matter	Be
SO ₂	Hg
NO _x	Asbestos
CO	Vinyl Chloride
NMHC	F
O ₃	H ₂ SO ₄ Mist
Pb	Total Reduced Sulfur Benzene?

TABLE 3. POLLUTANT DE MINIMIS LEVELS (CONTROLLED)

Pollutant	Guideline for BACT ton/year	Guideline for Detailed Impact Analysis
CO	100	500 $\mu\text{g}/\text{m}^3$ - 8 hr
NO ₂	10	1 $\mu\text{g}/\text{m}^3$ - Ann
TSP	10	5 $\mu\text{g}/\text{m}^3$ - 24 hr
SO ₂	10	5 $\mu\text{g}/\text{m}^3$ - 24 hr
O ₃ (VOC)	10	—
Pb	1	0.03 $\mu\text{g}/\text{m}^3$ - 3 mo
Hg	0.2	0.1 $\mu\text{g}/\text{m}^3$ - 24 hr
Be	0.004	0.005 $\mu\text{g}/\text{m}^3$ - 24 hr
Asbestos	1	1 $\mu\text{g}/\text{m}^3$ - 1 hr
F	0.02	0.01 $\mu\text{g}/\text{m}^3$ - 24 hr
H ₂ SO ₄	1	1 $\mu\text{g}/\text{m}^3$ - 24 hr
Vinyl chloride	1	1 $\mu\text{g}/\text{m}^3$ - Max
TRS		
H ₂ S	1	1 $\mu\text{g}/\text{m}^3$ - 1 hr
methyl mercaptan	1	0.5 $\mu\text{g}/\text{m}^3$ - 1 hr
dimethyl sulfide	1	0.5 $\mu\text{g}/\text{m}^3$ - 1 hr
dimethyl disulfide	1	2 $\mu\text{g}/\text{m}^3$ - 1 hr
CS ₂	10	200 $\mu\text{g}/\text{m}^3$ - 1 hr
CO _s	10	200 $\mu\text{g}/\text{m}^3$ - 1 hr

September 5, 1979 Federal Register 40 CFR 51 and 52

below de minimis levels (Table 3), (2) the requirement for an analyses of baseline air quality concentrations for all pollutants regulated under the Act, and (3) guidance on modelling, phased construction, and stack heights. The analyses for baseline pollutant concentrations may include one year of continuous monitoring. Alternatives would include either a showing that existing data (for NAAQS pollutants) collected at other locations were representative or modelling existing emissions (for non-NAAQS pollutants) in the area to estimate concentrations. Modelling guidance contained the opinion that air quality models are on the frontier of science but must be

used. It should be noted that the opinion was rendered that if a PSD increment was initially judged not to be violated but was later found to be violated, either through monitoring data or improvements in modelling techniques, the State Implementation Plan could/should be revised to require additional control.

EPA is involved in litigation regarding visibility regulations. Regulations were to have been promulgated by August 1979. Since they were not, FOE and EDF sought court relief. We were under court order to propose regulations by May 15, 1980 and to promulgate by November 18, 1980. Based upon limited visibility analyses performed via PSD reviews on oil shale projects to date, visibility protection could provide additional constraints, beyond the Class I PSD increments, to the size of an industry.

The size of an oil shale industry appears to be limited by air quality Class I increments at the Flat Tops Wilderness Area. This concept has caused significant activity in the past year by both industry and government. Preliminary analyses indicate that development of 200,000 to 400,000 BPD could consume the increment (Tables 4 and 5). While initially, several oil

TABLE 4. EPA MODELLING RESULTS 24-HOUR CONCENTRATIONS, $\mu\text{g}/\text{m}^3$

Prototype Lease Evaluations - 1976

● 200,000 BPD

	TSP	SO ₂
Dinosaur National Monument	~18	5
Colorado National Monument	<3	<1
White River National Forest	~8	<2
Ashley National Forest	~5	~1

PSD Permits - 1979

● Impacts on Flat Tops - 62,000 BPD

	TSP	SO ₂
C-a		
C-a	<0.1	0.3
C-b	0.5	<0.1
Colony/Union	1.4	1.1
Total	~2.0	1.5

$$\frac{5.0}{1.5} \times 62,000 \text{ BPD} = 207,000 \text{ BPD}$$

TABLE 5. EPA MODELLING RESULTS - 1980

Assumptions

- Box Model - 40 km wide, variable height
- 400,000 BPD
- "Colony type" emissions
- No chemical transformation or deposition
- No dispersion out of box
- Homogeneous mixing

Results, 24-hour concentrations

Meteorological Case Mixing Height and Wind Speed	TSP, $\mu\text{g}/\text{m}^3$	SO ₂ , $\mu\text{g}/\text{m}^3$
2500 m, 6 m/sec	0.4 $\mu\text{g}/\text{m}^3$	0.5 $\mu\text{g}/\text{m}^3$
1000 m, 5 m/sec	1.3	1.6
500 m, 5 m/sec	2.6	3.2
500 m, 3 m/sec	4.4	5.4
400 m, 4 m/sec	4.1	5.0

Notes

Mean annual meteorological conditions

a.m. mixing height	400 m
p.m. mixing height	2500 m
a.m. wind speed	4 m/sec
p.m. wind speed	6 m/sec

TABLE 6. PSD PERMIT EMISSION RATES

Pollutant	Colony	Union	Pounds Per Barrel of Oil	
			C-b	C-a
SO ₂	0.164	0.237	0.160	0.668
NO _x	0.903	0.291	—	—
HC	0.158	0.125	—	—
PM	0.134	0.102	—	—
CO	0.036	0.172	—	—

shale developers considered rushing in to get their share of the increment, this has not occurred. EPA has recognized that a Regional Complex Terrain Model applicable for oil shale country must be developed. A "planning accuracy" model will be developed by Summer 1980. Also, the design of a two-year field data gathering effort followed by model development or refinement has been initiated. The goal is to have a useable Regional model for use in permitting decisions by 1982. Joint funding between government and industry is being sought.

The review of PSD permit applications is establishing a better emissions data base than previously available. To date, PSD permits have been issued for five oil shale projects. Table 6 shows permitted emissions rates on a per barrel of oil produced for four of the permits. The fifth permit was for a research-type operation. Given the concern over consumption of the PSD increments, the conclusion was that these permitted limits should provide an upper benchmark for future applications. In order to provide a comparison between a Synfuels facility and a conventional fossil fuel plant, Table 7, compares the Colony emissions rate to a conventional 1000 MWe coal-fired power plant meeting New Source Performance Standards (NSPS). These facilities are comparable on an energy basis of coal input and oil output.

Underground injection control regulations were promulgated May 19 and June 24, 1980. *In situ* oil shale facilities are treated as Class III wells. This classification requires proper disposal and monitoring requirements. Wells must be properly cased, injection fluids characterized, and groundwater quality monitored.

The salinity litigation involving EPA and EDF was ruled in favor of EPA in Fall 1979. Thus, the Colorado River Basin Forum plan and standards at three locations on the Colorado remain intact. Colorado is reviewing all of their water quality standards and stream classifications. Of special interest to oil shale

TABLE 7. OIL SHALE vs. POWER PLANT COMPARISON

Pollutant	50,000 BPD Colony	Tons per Year 1000 MWe Power Plant
SO ₂	1239	13,790
PM	1008	1,062
NO _x	6817	17,714

developers has been the proposed classification of Piceance Creek as a cold water fishery. This designation would impose extremely stringent limits on any potential discharges.

Several other regulatory policy/procedure issues are addressed in the EPA "Perspectives" document which will be discussed later. These include (1) PSD increment consumption, (2) NAAQS policies, (3) air modelling responsibilities, (4) future Wilderness areas, (5) PSD monitoring, (6) permit bases — BACT, BMP, and costs, (7) permit lifetimes, (8) consolidated hearings, (9) completed application requirements, (10) permit enforcement procedures, (11) regulation certainty, (12) stream classifications, (13) salinity, (14) TSCA, and (15) program delegations.

Research Program

EPA's Office of Research and Development has been reorganized and divided into the Office of Monitoring and Technical Support, Office of Environmental Engineering and Technology, Office of Environmental Processes and Effects Research, and the Office of Health Research. All of these offices are actively involved in oil shale research with a collective budget of approximately \$5 million in fiscal 1980.

Within EPA, several separate laboratories conduct or contract for oil shale-related environmental studies. The Office of Environmental Processes and Effects acts as coordinator for the Interagency Program. The Office of Environmental Engineering and Technology (OEET) has contract work in the area of overall assessments and control technology. The Industrial Environmental Research Laboratory in Cincinnati (IERL-Ci) funds and manages research on overall assessments, extraction and handling, processing and management and control of all pollutants. Research laboratories in Ada, Oklahoma; Athens, Georgia; Duluth, Minnesota; Las Vegas, Nevada; and Research Triangle Park, North Carolina conduct research studies in the processes and effects area. Shale oil product (end use) studies are managed and funded by both the Industrial Environmental Research Laboratory at Research Triangle Park (IERL-RTP) and Ann Arbor (Michigan) Emission Control Technology Division (ECTD) of the Office of Air, Noise and Radiation.

Specific objectives of the EPA Oil Shale Program are two-fold: first, the program is to support the regulatory goals of the Agency; second, the research is to be directed towards ensuring that any oil shale industry to be developed will be accomplished in the most environmentally acceptable manner. To these ends, EPA is continuing to assess the research needs and environmental concerns expressed by the Department of Energy (DOE) and the oil shale industry.

A budget breakdown and description of specific individual research projects is present in "Program Status Report - Oil Shale - 1980 Update" (EPA-600/7-80-069). Therefore, a detailed discussion on ongoing research activities will be omitted in this paper.

The types of research projects include long-term revegetation success of processed shale, raw and processed shale leaching experiments, residuals characterization at the Geokinetics project, characterization and treatability studies of produced mine and retort water, characterization of the mineral composition of *in situ* spent shale, assessment of appropriately reduced sulfur controls, characterization and treatability studies of retort offgas, visibility studies, development of groundwater monitoring strategies, development of appropriate surface water chemical and biological methods, and development of monitoring guidance.

Two key outputs of the research program involve the publication of oil shale guidance documents.

In the Fall of 1978, the Office of Research and Development of the Environmental Protection Agency began efforts to provide reference documents and guidance to EPA offices, federal and state agencies, industry and the public, or environmental issues related to oil shale. These documents are intended to assure that the development of a mature oil shale industry is not delayed by uncertainties while assuring that the industry develops in a manner which is compatible with national environmental goals.

The major thrust and accomplishments over the past year have included: the development of the document "Environmental Perspective on the Emerging Oil Shale Industry" which presents general information relevant to oil shale pollution problems and their control as they are viewed today; and the initiation of work on a pollution control technology guidance document which will discuss the applicability, performance and costs of pollution control alternatives available for the oil shale industry.

The first document became available in draft form in the Summer of 1979 under the title "Pollution Control Guidance for Oil Shale Development - Revised Draft Report." Following extensive review by EPA, other government agencies, the oil shale industry, and the environmental community, numerous changes were made including the title. This document now entitled "Environmental Perspective on the Emerging Oil Shale Industry" is undergoing final review with public release expected in February 1981 (EPA-600/2-80-205a). This report, prepared by the EPA Oil Shale Research Group, will convey EPA's

understanding and perspective of environmental aspects of oil shale development by providing a summation of available information on oil shale resources; a summary of major air, water, solid waste, health, and other environmental impacts; an analysis of potentially applicable pollution control technology; a guide for the sampling, analysis, and monitoring of emissions, effluents, and solid wastes from oil shale processes; suggestions for environmental goals, and a summary of major retorting processes, emissions and effluents.

EPA is now preparing a second document, "Pollution Control Guidance for Oil Shale," with the first draft expected by the end of calendar year 1980. This document is being prepared by the EPA Oil Shale Work Group under direction provided by the Office of Environmental Engineering and Technology and the Industrial Environmental Research Laboratory, Cincinnati.

This document will present a critical and detailed analysis of pollution control alternatives for a commercial oil shale industry. The document will contain extensive information on the design, performance and cost of a wide variety of available environmental control technology options applicable to oil shale processing. Control options will be considered as they specifically apply to oil shale through the use of six case studies as a data base and reference point. The six case studies will cover the following active oil shale development projects all of which are expected to reach commercial operation by 1990:

- TOSCO/Colony Development in Parachute Creek
- Union Oil Development in Parachute Creek
- White River Project at Ua,Ub using the Paraho Process
- Superior Oil Multimineral Development
- Occidental Development of Tract C-b
- Rio Blanco Development at Tract C-a

Emphasis will also be placed on identifying important areas of uncertainty, and on specifying the assumptions made in the analysis.

The EPA envisions this document as the second of a series leading toward the eventual establishment of regulatory standards for the oil shale industry. The document is expected to serve several purposes. First, a comprehensive, state-of-the-art understanding of pollution control alternatives for oil shale using

current knowledge will be established, supported by extensive data on design, performance and cost. Second, a comprehensive understanding of important areas of uncertainty in pollution control will be developed. Third, the document will provide a basis for a high level of communication between the EPA, industry, and the public on pollution control for oil shale. Finally, the document will serve as an important and updatable reference on oil shale pollution control.

The reader should keep in mind that the present data base used in the development of the Pollution Control Guidance Document is incomplete, and only preliminary decisions can be made in evaluating pollution control options. The purpose is to provide a first-cut, broad base of information which specifically addresses the pollution control problems faced by the oil shale industry; such a base should stimulate the proper concern and cooperation to assure that the industry develops in an environmentally acceptable fashion and is not delayed by uncertainties regarding environmental standards.

Extensive review by EPA's regulatory offices, Region III, other government agencies, industry, and public interest groups is planned prior to release of this document. Public distribution is scheduled for the Summer of 1981.

Alternate Fuels Group

On January 18, 1980, EPA established a management structure designed to be responsive to the President's Synthetic Fuels and Energy Mobilization Board initiatives. Two policy groups, the Alternate Fuels Group and the Permits Coordination Group, will operate under the direction of the EMB Task Force. The Alternate Fuels Group will develop the Agency's regulatory and research strategy for synthetic fuels industries. Working groups within the AFG have been established for oil shale, direct coal liquefaction, indirect coal liquefaction and coal gasification, and ethanol from biomass. The AFG will coordinate preparation of environmental guidance for these emerging technologies for use by industry planners and permitting officials. The AFG will also recommend and oversee preparation and promulgation of control technology based standards for synthetic fuels facilities. The preparation of Pollution Control Guidance Documents (PCGD) will provide the first component of the basis for these standards. The first draft of the oil shale PCGD is scheduled for late 1980. Industry, government and the public will be asked to review and provide comment on the draft PCGD. Final publication is slated for Summer 1981. The second policy group, Permits Coordination Group (PCG), will

provide national management of permitting mechanisms in order to respond effectively to demands for expediting permit decisions. The PCG will develop a system for tracking permits, establish project decision schedules for permit review, and assure that potential environmental and permitting problems are recognized early.

Unanswered Environmental Issues

Mining and conversion of oil shale will degrade air quality, will consume precious water resources, may degrade surface and/or groundwater quality, will create solid and hazardous wastes to be disposed of properly, and will create significant population growth in a predominantly rural setting which translates into potential social and economic problems. That these things will occur is a given...the question is the magnitude and the significance of the occurrence. Key questions such as the following exist:

1. How much ground water will be intercepted during mining?
2. What will the quality of potential discharge be?
3. Can groundwater quality be protected during and after *in situ* retorting?
4. Can processed shale be disposed of properly without degrading ground or surface water quality?
5. Will revegetation of processed shale be successful over the long run?
6. What are the concentrations of various sulfur species in retort offgas streams and what is the best approach to control these compounds?
7. What will be the air quality and visibility impacts on the Flat Tops Wilderness Area (nearest Class I area)?
8. What are the expected trace element concentrations in air, water, and solid waste residual streams?
9. Is conventional pollution control technology directly applicable to oil shale residuals? Is it effective?
10. What is the expected population growth associated with the development of an oil shale industry?

These questions may look familiar. They should, since they are the same ones posed in our EPA presentation at the 12th Annual Oil Shale Symposium. The fact that they remain unanswered points out to us that the environment is not much closer to being ready for oil shale than it was a year ago.

Answers to the above questions (and perhaps other questions not yet posed) will in part determine the ability of individual plants and of an oil shale industry to be compatible with the desired environment for oil shale country.

Answers to some of the questions may be partially answered by theoretical research work and limited scope field investigations in the absence of *any* oil shale facilities. Answers to the remaining questions will necessarily be developed through rigorous testing programs and data analyses performed on facilities representative of commercial size. Reliable answers will be obtained only through a cooperative coordinated effort among government and industry.

Conclusions

Development of oil shale appears to be closer to reality than ever before. EPA has for years advocated that some small-scale development occur so that some of the unanswered environmental questions could be resolved. This remains EPA's philosophy toward the development of oil shale. EPA Region VIII has provided specific guidance on its posture toward oil shale development in its Energy Policy Statement, issued as a draft in Fall of 1979 and finalized in April 1980. Items addressed in the Statement which relate directly to oil shale development include (1) expedited permit processing, (2) grandfathering, (3) rate of development, (4) "Better than BACT" controls, (5) EPA input to DOI on additional leasing, (6) planning and implementing a coordinated research effort, and (7) information and communication efforts.

If oil shale development proves to be economically attractive and technologically feasible, EPA advocates that development occur in an orderly phased manner. Development up to some undetermined size of industry can and must occur in a manner compatible with environmental standards and objectives.